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The Role of Juvenile Elk and Moose in the Social Dynamics of Their Species

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Analysis of the social behavior patterns in wild, free-ranging ungulates has led to the recognition of definite periods of stress and readjustment in some animals. Among the age groups studied under a long-range plan (Altmann, 1958, 1959), the juveniles in elk and moose were quite obviously such a problem group. This study aims to point out the role of these "in-between-agers" and their interactions with the social order of their species.

As juveniles we designated the one-year-old elk and the one-and-two-year-old moose of both sexes. They are no longer accepted as calves, but do not rate as yet as adults. The two particular species under investigation were the wapiti, or Wyoming elk *(Cervus canadensis nelsoni)*, and the Wyoming moose *(Alces alces shirasi)*. The behavior observations were carried out in the Teton Wilderness area of Wyoming and in Grand Teton National Park, respectively, main ly over a period of three years (1956-58), but supplemented by additional notes from a nine-year period in the same area. The work was supported by grants in aid from the National Science Foundation and the New York Zoological Society. Our appreciation of the grants in aid and of the kind encouragement by Dr. L. F. Clarke, Research Station Director at Moran, Wyoming, headquarters of the investigation, is herewith expressed.

Observations of juvenile elk and moose over the three-year (1956-58) period were made on 1,663 animals in 931 observation periods, varying in duration from 14 minutes to 4 hours.

Dawn and dusk hours provided the majority of the observational material, but moonlight and daytime records were also included in order to get a balanced ethological picture.

The distance from the observed animal varied from 12 feet (in hiding) to one and a half miles (from lookout). The use of 7 × 50 light-weight binoculars and of a 15- or 27-power B. & L. spotting scope on a tripod provided the means of accurate wide-field observation. In the study of social situations involving "marginal" activity of the juveniles, such equipment permitted long range observations and yielded discoveries not possible by a close-up stalk.

A graduate student assistant, Mr. James R. Ruos, participated in some phases of the observations with great efficiency.

The two big game species selected for this study have been previously shown to have striking differences in their social organization and in their calf-raising patterns (Altmann, 1959).

The general dynamics of the elk and moose groups have been presented elsewhere (Altmann, 1952, 1956, 1959; Denniston, 1956; Dodds, 1958).

This paper deals with the changes which the individual animal, in particular the juvenile, has to undergo in adaptation or in resistance to group formation and dissolution.

As a rule, it appears at first to an observer that there is great uniformity of expressions and behavior reaction in all group individuals. With more intense observation and effort, however, one discovers more and more individual differences in morphology as well as in behavioral detail. At the same time definite patterns of behavior become more apparent and allow the recognition of trends. We are, even after twelve years of work on such problems, still quite absorbed in finding species-specific and group-specific behavior. But we are also fully aware of many cases of "marginal behavior" and of nonconformity and deviation in some animals.

Keeping careful tab on the non-conforming individuals, we intend to investigate their occurence and fate in individual case histories against the background of their respective groups.

So far, it appears that the juvenile age class exhibits more non-conforming behavior, but it remains to be seen[1] whether the aging or aged wild ungulates equal or exceed them in this respect.

An examination of juvenile behavior in moose and elk must take into consideration the social background and the typical calfhood experiences in the development pattern of each species.

Moose Juveniles

In the moose, emergence from the calfhood pattern has its beginning during the fall rutting season. The calf's dam comes in heat and joins a bull moose, and the calf by her side is integrated into the mating group. At this time, weaning of the calf is in progress and its complete isolation from other members of its own kind is relaxed by its dam. The hardships of the first winter follow and leave their mark on most moose calves. Leadership and protection by the cow appear to be still an essential requirement for the survival of the calf, even after weaning is completed. The daily routine, feeding, rest, shelter selection, defense and evasion activities are determined by the cow moose for the weaned calf all through the winter.

Then at the climax of the period of scarcity and hardship in early spring, the heavily pregnant cow moose becomes gradually more and more hostile toward her growing yearling, when at close range. About 10 to 15 days before the birth of the new calf the cow chases the yearling from her side. Confusion is the first reaction of the yearling to this new situation. Circling and aimless drifting and irregular feeding are characteristic, and it makes numerous attempts over many days to rejoin its dam, by approach and by following her footsteps again. When the yearling eventually, after 12 to 25 frustrated attempts, learns to stay at the "safe distance" from the dam (200-300 feet), it continues nevertheless to participate in her general movements and routine activities. This is often done barely within sight; at times beyond the visible distance, by scenting and listening, This life "in the margin" is endured by the majority of yearlings. Some juvenile moose of both sexes, however, do not remain "in the margin" for long. They leave and stay solitary or try to find an association with other unattached moose, usually with older bulls. Such a partnership with one or more elder moose is frequently established by juvenile bulls—in rare instances also by female yearlings. This association is called a "satellite attachment" in our study, since direction and type of activity are determined by the older partner. Remarkable tolerance and non-aggression characterize this relationship in general. The satellite condition appears to substitute for the dam-yearling attachment and usually lasts all summer long, up to the rutting time in September, when another critical period arises for the juveniles.

During the pre-rutting period in August this satellite moose relationship gradually undergoes changes which lead to its deterioration. First sign of tension between the older bulls and their satellite partners is a tendency to mock fight and tussle more intensively. This accompanies the velvet-rubbing time, which in mature moose bulls begins earlier (late August), in juveniles later. Satellite groups running in single file over extended areas (3-6 miles per day) were observed at this stage of the pre-rut. Periods of over-activity alternate with quiet browsing and grazing in peaceful unity. The number of animals in such satellite groups is variable. Two and three are found most frequently, but some groups may contain five and up to nine members on occasion. In the larger groups there is a changing leadership role and no longtime group cohesion, but the juveniles—the yearlings and two-year-olds—do not play leading roles in such groups. The tolerance of the bull moose toward their satellites diminishes, and the spacing within the still-persisting groups widens. On narrow trails, passages or salt licks the juvenile stays cautiously out of reach of mature bulls or waits in cover until they have passed.

The end stage of the satellite relationship occurs when the actual rut begins. The rutting bull moose threatens or fights off all satellite attachments. If former satellites are met, the rutting bull moose will threaten them as if they were strangers.

Another less frequently occurring form of attachment in juvenile moose is the banding together of two to several immature animals, designated as "clubs" in this paper. "Clubs" differ from the satellites in mode of violent, erratic travel and in lack of steadiness and become most conspicuous during the pre-rut.

By the end of August, with feeding conditions at their best, the juveniles as well as the mature moose are in supreme physical condition. It is in those few weeks, preceding the actual rutting period (September and October) that the special behavior patterns of the pre-rut are evident in the juvenile moose. There is, no doubt, a partial activation of the sex drive in both sexes, but it is more intense in the juvenile males. The young moose bulls are excitable, feed only intermittently and drive their club partners, irre-

[1] Our current research phase, on an N.I.M.H. grant, deals with the role of aging and aged wild ungulates.

spective of their sex. Much tussling, kicking and running in circles takes place. It is apparent that an expression of the rutting drive at this time is present in most well-developed juvenile moose, as well as in those attached as satellites, or in solitary and marginal positions. Increased restlessness and irritability are indicators of this condition but its manifestation is more or less suppressed or kept under control by the presence of dominant, mature members of the species. Remnants of this pre-rutting behavior, however, can be found in various degrees of strength or suppression.

The juvenile moose, living in "the margin," succeeds at times, after a number of weeks, in reapproaching its dam and being tolerated for a while. But the pre-rut and the onset of the rutting period bring increased difficulties for the immature moose of both sexes. If the juvenile is a male, the threat of the bull moose will keep him under stress and dislodge him again. If the juvenile is a female, its own dam chases it from the proximity of the bull and from the wallow which is usually the focus of the cows' attention (Altmann, 1959). It was noticed in our observations that occasionally moose juveniles were tolerated near the mating group, but this always involved poorly developed yearlings, individuals of quiet and submissive behavior.

Elk Juveniles

The social situation of juvenile elk is also characterized by critical periods of adjustment, in which existing bonds are loosened and dissolved and new associations become necessary. But the social organization of elk, with their definite herd formation, modifies and reduces the impact of such changes, at least for the female juvenile.

The elk cow-calf relationship is from the very beginning, the day of birth, built upon a "spacing basis." For several weeks the calf is left hidden for hours at a time, while the dam rejoins the herd groups for grazing. Later, at about 20 days of age, when the calf is following the cow, it does so in a herd-integrated manner, not "heeling" as closely as the moose calf follows its dam. When a disturbance of the herd occurs, the cow often leaves the calf with other group members, covering their retreat by a special shielding maneuvre (Altmann, 1956) which is also based on a spacing, not on a closeness, reaction.

In this way each elk yearling is from calfhood on integrated as a member of a group (band) or herd. As such it is not quite so dependent upon the close association with its own dam. Nevertheless, the elk yearling attempts to gradually weaken the barrier of distance established and rigidly enforced by the cow at the birth of a new calf. The opportunity to do this arises for the yearling at times during the resumption of the migration, as soon as the stationary pause for calving is terminated. In most of the observed cases the yearlings were not tolerated in the close vicinity of the dam and the young calf. Two exceptional cases were noted in different years and locations, when a yearling elk knelt down and nursed an elk cow, who apparently had lost her young calf. No obvious resistance to this nursing procedure was noticeable. One yearling was a female (1951), the other a spike bull (1954).

As the high summer ranges get gradually dryer and the big nursery herds of elk begin to break into smaller groups grazing in the secondary valley slopes and meadows toward the end of August, the pre-rut of elk gets under way.

Distinctive changes in individual activity and group structure become apparent. The big mature elk bulls are dispersed in the timbered areas in order to rub the velvet off their antlers in preparation for the rut. The yearling spike bulls suddenly show greater activity and display overt sexual behavior.

Driving, "tending,"[2] mounting elk cows and mock fighting among each other characterize this "pre-rut pattern." Actual mating does not take place, since the cows are not yet in heat. They are, in fact, most refractory to the advances of the yearling bulls. Squealing, kicking and bugling with a high-pitched, juvenile voice, the yearling bulls create a veritable upheaval in the small herds and by their behavior obviously break up the routine of daily activities. Erratic and incomplete as it appears, the sex behavior of the juvenile elk has a number of characteristics of the adult rutting pattern—the tending, mounting, bugling, reduced feeding and increased locomotion. The pre-rut lasts about three weeks and then, with the reappearance of the mature bulls from their timber hideouts, the role of the spikes suddenly changes. In the most emphatic manner the spikes are driven away from the cow-calf groups by the harem-owning bull elk. This change has all the indications of psychological castration for the juvenile spikes.

In the rutting season the female juvenile elk (yearling) does not have to leave her accustomed group. There is, in contrast to the situation of the juvenile spike bull, no direct threat and tension in store for her. Although subject to the rather violent herding action of the harem bull, the female elk yearling takes all her cues

[2] Tending as defined by T. McHugh (1958), is the close-up following of the cow by the bull.

for feeding and resting, for moving and flight, from her dam or its group. If the elk dam is "cut out" of the harem by a rival bull elk, the female yearling usually breaks out of the group also and, like the calf, follows the dam into the new harem. However, in all these actions the yearling stays at least at the "critical distance" from the dam as long as there is a calf present. In elk harems there is no sign of female sex competition but the same group cohesion and compatibility prevail as at other seasons. This is in our opinion an important factor which keeps the groups intact and prevents dispersion, in spite of wide spacing, which even the most vigilant harem bull could not prevent.

For the yearling bulls (spikes), however, a highly threatening situation arises with the onset of the rutting season. Not only is the spike chased out of his accustomed group by the now domineering harem bull, but after leaving he finds himself in a very insecure situation. In addition to well recognizable elk groups the juvenile now everywhere encounters roaming, unattached bulls which are bugling and challenging other males and searching for a breeding chance or a rival. Fright builds up like a chain-reaction in the spikes and the result is confused drifting and, when exhausted, disregard of most other normally-shown precautions against danger. Under the stress of fear from mature bulls these juveniles will often act irrationally and, as I have also shown previously (Altmann, 1956), rather meet and follow a pack train or invade a camp than face a bugling mature bull.

Winter Grouping

As the main rutting gradually draws to a close and the mature males are spent, there is occasionally a terminal expression or rutting behavior in the juvenile elk and moose, but the general regrouping of the elk and moose under the influence of the first severe winter weather and dwindling food supplies obscures a clear manifestation. The fall migration in the elk and the winter aggregation of the moose in the lower river drainages permit the juveniles to rejoin the others without danger. There is still, of course, a "peck order" of sorts within the loose groups. The juveniles rank low therein, almost always below the last adult animal, but quiet yielding and submission have taken the place of upheaval and persecution. In a lowly, but as such well-defined social rank, the juvenile elk and moose spend the winter months.

Vocal communications play a limited role in juvenile elk and moose. The spike elk bugle, or try to bugle, during the pre-rut. Juvenile moose in our experience are not vocal except for small grunts of warning or anger when disturbed. Juvenile elk and moose use in gait, in posture and in gesture the same signals as the adults and can send as well as receive these signals. This is different from the situation at the calf age when signals were practiced and executed but the adults did not attach any significance to them. For example, a band of elk cows would not be alarmed by a calf in high stepping gait but would immediately heed a yearling's warning gait by flight. Or, an adult moose would not counter the aggression gesture (ears folded back, head raised, mouth chewing) of a calf but would without delay respond violently to a threat by a yearling.

Play among juvenile elk is frequently seen, particularly in the pre-rut. Running, flight and fight games with adults and often with older calves in shallow water or in meadows are a regular elk activity on summer evenings.

In salt licks or in other critical areas of limited space the juveniles have to yield to the higher social rank of adults and even to the calves, who rank with their respective dams.

During most of the year the juvenile moose and elk are not aggressive, but this can be rapidly changed under special conditions. Such is the case in juvenile moose in deep, non-bearing snow cover, as shown also by Pruitt (1960), or in fence enclosures when the "cornered" animal attemps to fight its way out by attacking man or any other species in its way. The aggressive mood and intention of the juveniles is always clearly recognizable by folded-back ears, chewing, salivation and rising hair on hump and neck region, slow lifting of front feet and stamping of the ground a few times, as in adult animals. Striking is done with the forefeet in quick, drum-like barrages, often from above while rising on the hindfeet.

In considering the tense situation of the juvenile moose and elk and the condition of stress during many months, one cannot be surprised to find that this age group actually has heavy mortality losses (Peterson, 1955). The exact extent of the juvenile mortality rate is quite frequently obscured by difficulties in counting and recognition of juveniles in aerial and other counts.

The difficulties in social adjustment become more crucial when physiological burdens of malnutrition and parasitism during the winter months are added to lower the vitality of juveniles.

Toward the end of winter the majority of the observed juveniles, in particular the young moose, appeared very emaciated and ragged, but those who survived recovered in a remarkably short time. Healthy weight gain and glossy

appearance of the pelage were reached usually within 6 to 7 weeks.

In the year following their problem age as juveniles, the elk and moose very gradually, but not completely, reach the social status of young adults. To a varying degree this new situation frees them from the handicaps of the juvenile status, but a close observer may still notice the traces of last year's social difficulties in the critical period of the rutting season and in other competitive situations.

Summary

Among the age groups studied under a long-range plan concerning free-ranging wild ungulates, the juveniles in elk (*Cervus canadensis nelsoni*) and moose (*Alces alces shirasi*) were obviously a problem group. The role of these juveniles and their interaction with the social order of their species is investigated.

The juvenile moose undergoes a critical period when its dam chases it from its side before the birth of the new calf. Various difficulties in adaptation to the new situation for the juvenile are shown, among them its role as a satellite to adult males, the life in the margin and the formation of juvenile clubs.

After a brief flare-up of juvenile rutting behavior in the so-called "pre-rut" period, further stress situations are faced by elk and moose juveniles in the fall rutting season of their dams, when young males are driven out by the mature bulls, and females (moose only) have to cope with hostility of mature cows.

Differences in social structure between moose and elk groups are shown to affect the role of the juveniles. In general the results point to the role of the juveniles as a rejected and most erratic, non-conforming age group.

Accumulative effects of poor winter nutrition, parasitic infestation, and difficulties in social adjustment bring about a lowering of vitality of elk and moose juveniles toward the end of the winter.

The surviving juveniles, however, regain weight and health in early summer at a fast rate. Integration into adult social status is gradual with a variety of drawbacks, in particular during the next rutting season.

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